Express Mail No.: EV 333133705 US
Title: Statistic Parameterized Control Loop for
Compensating Power and Extinction Ratio of a
Laser Diode
Inventor: Cheng Youn Lu
Atty. Docket No.: 21676-07366
Sheet 1 of 9

FIG. 1

Express Mail No.: EV 333133705 US
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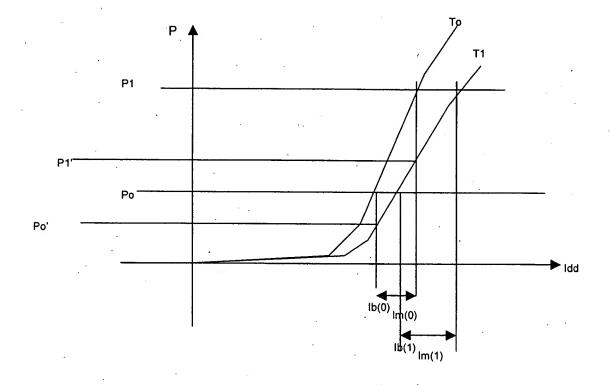Atty. Docket No.: 21676-07366
Sheet 2 of 9

FIG. 2

Express Mail No.: EV 333133705 US
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Inventor: Cheng Youn Lu
Atty. Docket No.: 21676-07366
Sheet 3 of 9

300

Measured current

404   407   402

MPD   PD   LD   Data input

ip   Ib, im
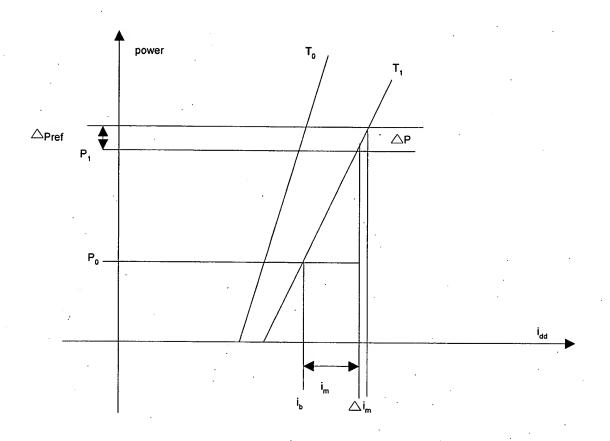
APC control
circuit

310

FIG. 3

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Atty. Docket No.: 21676-07366
Sheet 4 of 9

400

406   404   407   402

LP filter   MPD   PD   Laser Diode

i_p

A/D   in   APC   (e.g. DSP)   DAC   418 I_{b_out} Laser Diode drive Current Generator

408   410   420   428   422

DAC I_{m_out} 426

Data in   2   424

FIG. 4

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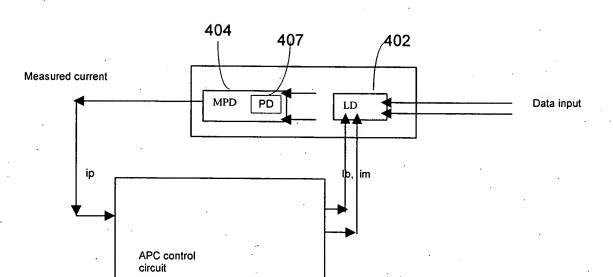Inventor: Cheng Youn Lu
Atty. Docket No.: 21676-07366
Sheet 5 of 9

FIG. 5

Express Mail No.: EV 333133705 US
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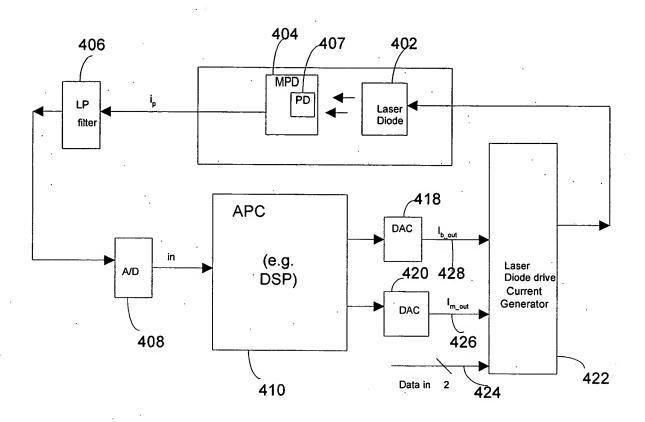Atty. Docket No.: 21676-07366
Sheet 6 of 9

600

Determine laser diode drive current components i_b and i_m for a reference P_1 level and a reference P_0 level.

602

Determine a reference average power and a reference power variance for the reference P1 and P0 levels.

604

Adjust the bias current i_b and the modulation current i_m simultaneously for maintaining the reference average power and the reference extinction ratio.

606

Has interrupt been received requesting recalibration?

608

Yes

No

Wait sampling time period.

610
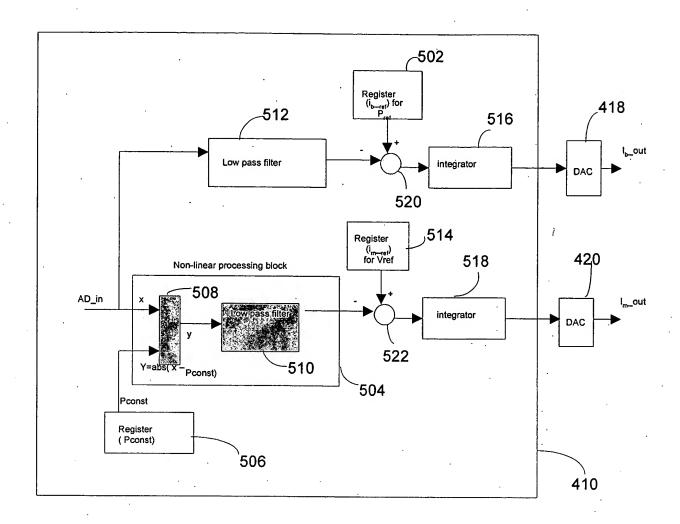
FIG. 6

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Atty. Docket No.: 21676-07366
Sheet 7 of 9

Initalize parameters.
(e.g. count =
$0; I_{b-out}(n) = 0$; n=1;
z(0)= 0) — 702

700

Set target = P_0. — 704

708

count > calib_T/2 ? — Yes → count< calib_T ? — 706 — No → $i_b\_P_1 = i_{b-out}(n-1)$ — 724

No / Yes

$z(n) = AD\_in(n) - target$. — 710

$I_{b-out}(n) = z(n) * loopgain\_cal + i_{b-out}(n-1)$. — 712

$i_b\_out = i_b\_P_0$. — 726

$i_{m\_out} = i_b\_P_1 - i_b\_P_0$. — 728

718

count = calib_T/2 ? — Yes → $i_b\_P_0 = i_b\_o(n-1)$. — 720 → Set target = P_1. — 722
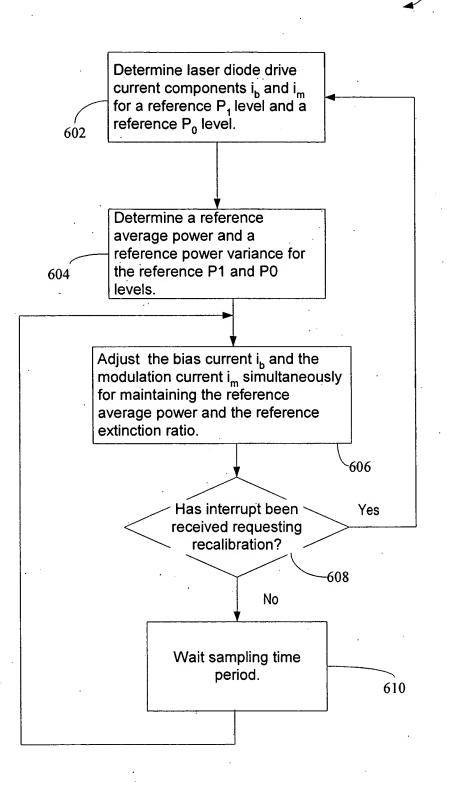
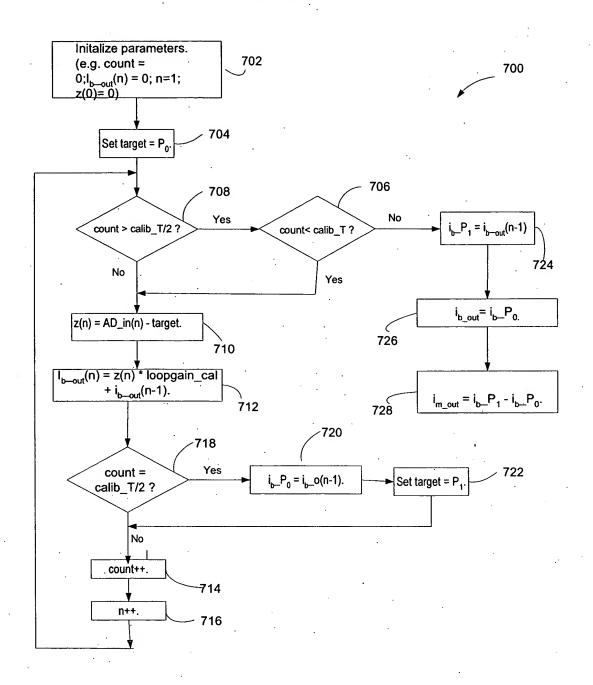No

count++. — 714

n++. — 716

FIG. 7

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Diode
Inventor: Cheng Youn Lu
Atty. Docket No.: 21676-07366
Sheet 8 of 9

800

Initialize parameters:
count = 0; n = 1; y(0) =0; w(0) = 0.

802

804

Is count < Par_T?

No

Pref = w(n).

806

Vref = y(n).

808

Yes

n++

810

$w(n) = AD\_in(n) + a * w(n-1)$

812

$y(n) = abs(AD\_in(n) - P_{Const}) + a * y(n-1)$

814

count++

816

FIG. 8

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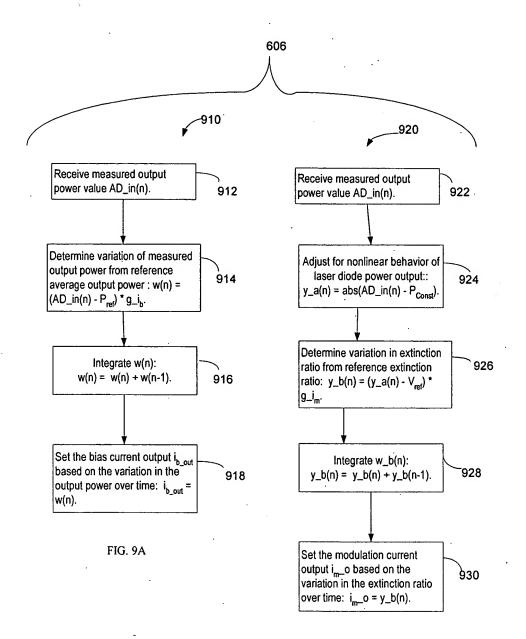Atty. Docket No.: 21676-07366
Sheet 9 of 9

606

910

920

| Receive measured output power value AD_in(n). | 912 |

| Receive measured output power value AD_in(n). | 922 |

| Determine variation of measured output power from reference average output power : $w(n) = (AD\_in(n) - P_{ref}) * g\_i_b$. | 914 |

| Adjust for nonlinear behavior of laser diode power output:: $y\_a(n) = abs(AD\_in(n) - P_{Const})$. | 924 |

| Integrate $w(n)$: $w(n) = w(n) + w(n-1)$. | 916 |

| Determine variation in extinction ratio from reference extinction ratio: $y\_b(n) = (y\_a(n) - V_{ref}) * g\_i_m$. | 926 |

| Set the bias current output i_{b_out} based on the variation in the output power over time: $i_{b\_out} = w(n)$. | 918 |

| Integrate $w\_b(n)$: $y\_b(n) = y\_b(n) + y\_b(n-1)$. | 928 |

FIG. 9A

| Set the modulation current output i_m_o based on the variation in the extinction ratio over time: $i_m\_o = y\_b(n)$. | 930 |

FIG. 9B